

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

DET5078 – ANALOG ELECTRONICS 2

(Diploma in Electronics Engineering)

11 OCTOBER 2017

2.30 PM – 4.30 PM

(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 5 pages with 5 questions only.
3. Attempt **ALL** questions. All necessary working steps must be shown.
4. Please write all your answers in the answer booklet provided.

QUESTION 1 [20 marks]

- (a) Sketch the diagram of a n-channel enhancement type MOSFET and explain its operation to turn on the MOSFET. (8 marks)
- (b) List down **TWO** major disadvantages of FET. (2 marks)
- (c) A JFET transistor circuit is shown in Figure 1. Given $R_D = 3 \text{ k}\Omega$, $R_G = 1 \text{ M}\Omega$, $V_{DD} = 15 \text{ V}$, $V_{GG} = 4 \text{ V}$, $I_{DSS} = 12 \text{ mA}$ and $V_p = -9 \text{ V}$.

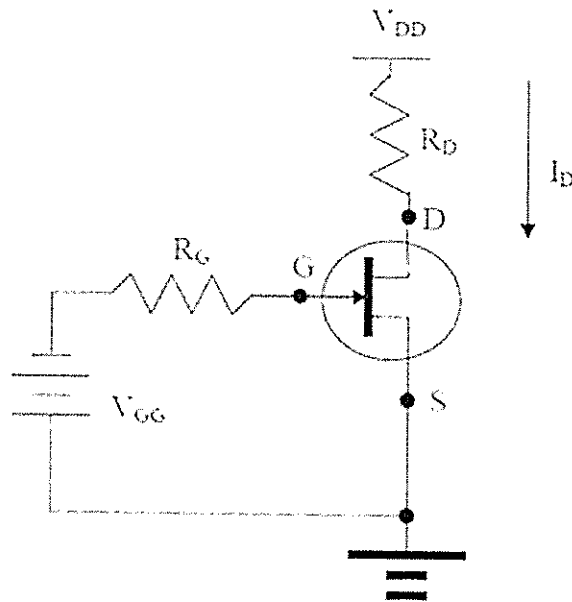


Figure 1

Determine the following:

- (i) Identify the type of the circuit configuration. (1 mark)
- (ii) V_{GSQ} and I_{DQ} (4 marks)
- (iii) V_D , V_{DS} and V_G (5 marks)

Continued ...

QUESTION 2 [20 marks]

- (a) Briefly explain the Miller theorem and sketch a simple circuit to illustrate the explanation. (5 marks)
- (b) A JFET equivalent circuit as shown in Figure 2 operates at 30 kHz with $R_G = 1\text{ M}\Omega$, $R_D = 125\text{ k}\Omega$, $R_L = 10\text{ k}\Omega$. The transconductance is $g_m = 2\text{ mA/V}$ while the internal resistance of JFET is $r_d = 50\text{ k}\Omega$. The coupling and bypass capacitors have large values of capacitance with $C_{gs} = 3\text{ pF}$, $C_{ds} = C_{gd} = 1\text{ pF}$.

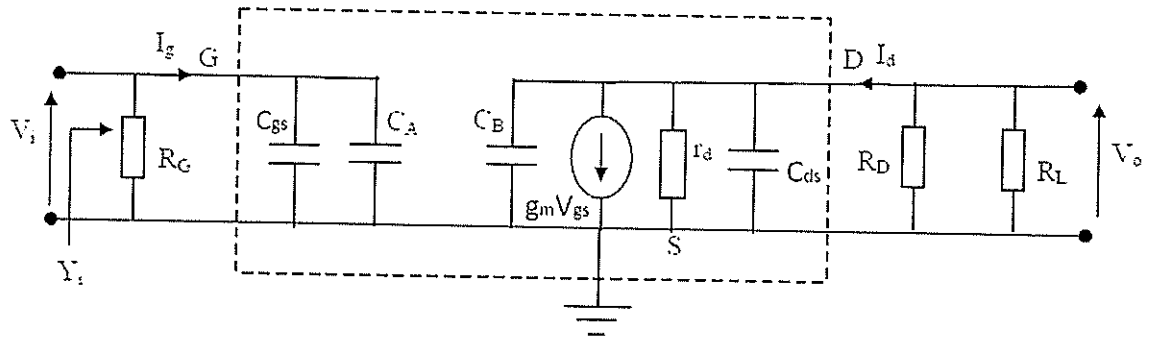


Figure 2

Determine the following:

- (i) Identify the type of the circuit configuration. (1 mark)
- (ii) $|A_v|$ (5 marks)
- (iii) Y_A (3 marks)
- (iv) $|Z_i|$ (6 marks)

Hint:

$$G = 1/R, \quad Y = j\omega C, \quad g = 1/r$$

$$Y_A = Y(1 - A_v), \quad Y_B = Y(1 - 1/A_v), \quad Y_i = G_G + Y_{gs} + Y_A$$

$$A_v = \frac{-g_m + Y_{gd}}{Y_{gd} + g_d + Y_{ds} + G_D + G_L}$$

Continued ...

QUESTION 3 [20 marks]

(a) Explain in details of the following amplifier noise:

(i) Thermal Noise (3 marks)

(ii) Shot Noise (3 marks)

(b) Describe the importance of the step response (high frequency response and low frequency response) in the amplifier analysis. (4 marks)

(c) A square wave signal is being input into an amplifier for testing purpose with the signal frequency of 20 kHz. The input and output signals are shown in Figure 3(a) and Figure 3(b) respectively.

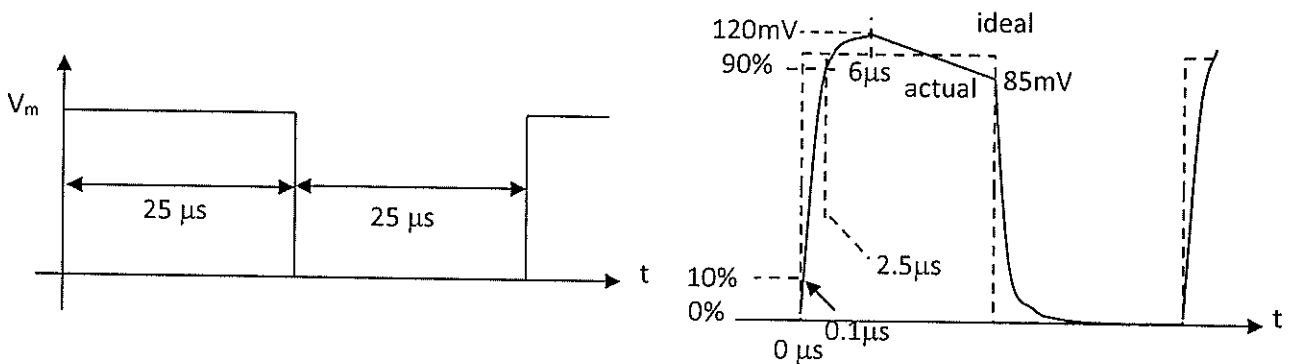


Figure 3(a): Input signals

Figure 3(b): Output signals.

Based on the figures shown above, answer the following:

(i) Determine the percentage of tilt. (3 marks)

(ii) Approximate the Lower Cutoff Frequency. (2 marks)

(iii) Define the Rise Time, t_r and calculate its value. (3 marks)

(iv) Approximate the Upper Cutoff Frequency. (2 marks)

Continued ...

QUESTION 4 [20 marks]

(a) Explain in detail for the following types of amplifier with illustration of signal:

- (i) Class A (3 marks)
- (ii) Class B (3 marks)
- (iii) Class C (3 marks)
- (iv) Class AB (3 marks)

(b) Describe the purpose of the power amplifier and provide one example on its application. (3 marks)

(c) For the operating power amplifier circuit as shown in Figure 4, answer the following:

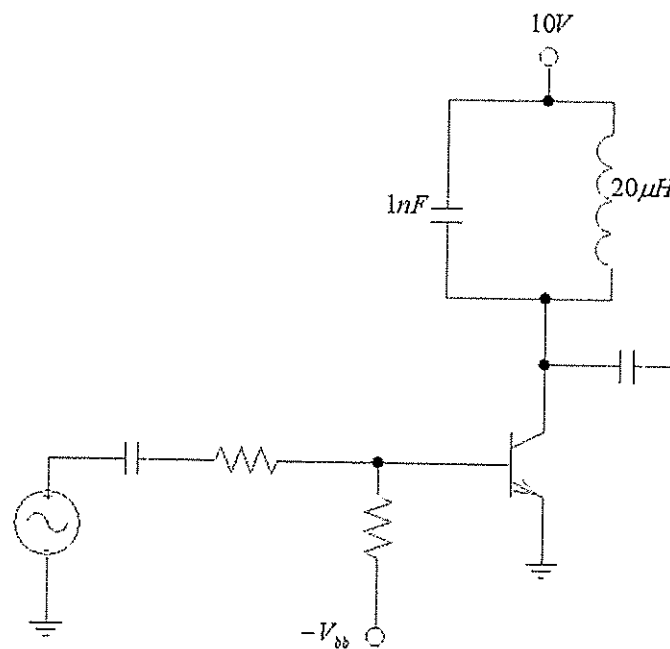


Figure 4

- (i) Identify the type of the amplifier (1 mark)
- (ii) Calculate the resonant frequency. (2 marks)
- (iii) If the coil has a resistance of 15Ω , find the quality value, Q . (2 marks)

Continued ...

QUESTION 5 [20 marks]

- (a) Briefly explain about astable, monostable and bistable multivibrators. (6 marks)
- (b) Give TWO comparison between the JFET switch and the BJT switch. (4 marks)
- (c) Design and draw a non-inverting Schmitt trigger circuit with $UTP = +6\text{ V}$ and $LTP = -3\text{ V}$. Assume that $R_1 = 2\text{ k}\Omega$ and supply voltages are $\pm 12\text{ V}$. (7 marks)
- (d) Given that the output waveform from a JFET has a space width of 10 s and a cycle time of 18 s. Determine the percentage of duty cycle. (3 marks)

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